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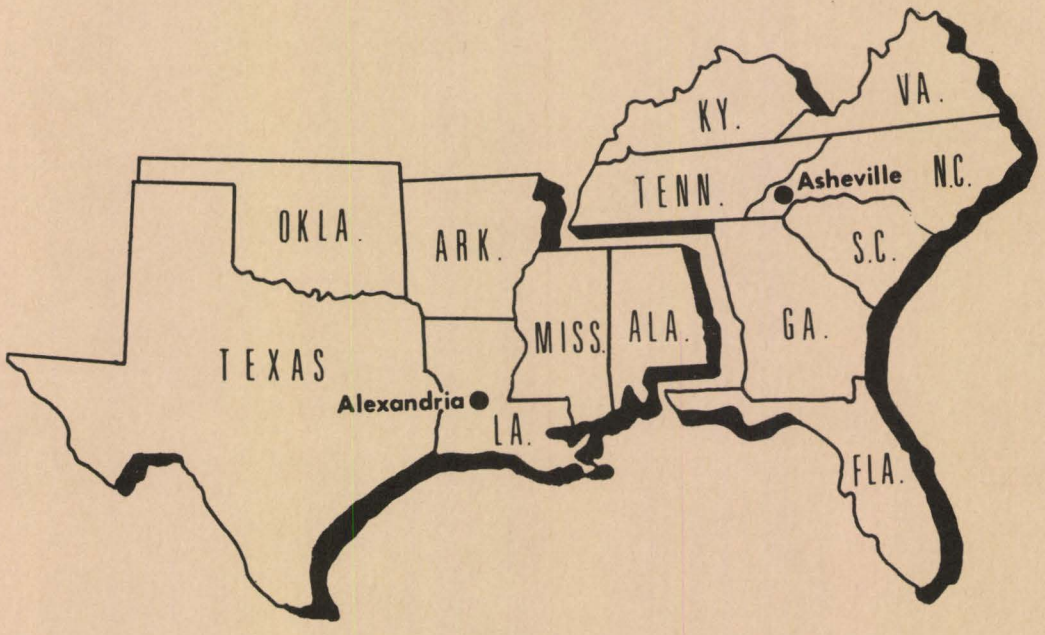

U.S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE
SOUTHEASTERN AREA, STATE AND PRIVATE FORESTRY
DIVISION OF FOREST PEST CONTROL

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A SURVEY FOR HARDWOOD STEM CANKER DISEASES ON A SELECTED AREA IN SOUTHWESTERN VIRGINIA

U.S. Forest Service
Asheville, North Carolina

By

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ABSTRACT

A survey for hardwood stem canker diseases in southwestern Virginia in November, 1968 revealed a relatively high disease incidence. Eleven percent of 225 scarlet and chestnut oaks examined on twelve sample plots had hispidus or strumella cankers. These two hardwood stem canker diseases are caused by the fungi *Polyporus hispidus* (Bull.) Fr. and *Strumella coryneoidea* Sacc. and Wint. Stem dissection of selected cankered oaks showed the average decay length (7.9 ft.) to be nearly four times the average canker length (2 ft.)

INTRODUCTION

Stem canker diseases cause considerable damage and cull to southern Appalachian hardwoods. Several hardwood species are affected. However,

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the damage is most significant to oaks. Total losses from cankers and resulting decay may amount to four percent of the cubic foot volume in southern hardwood stands (Toole, 1959). An allowance for decay cull of one foot above and one foot below cankers was developed from a Connecticut study (Sleeth and Bidwell, 1937).

Two of the most important and frequently encountered hardwood stem canker diseases are hispidus canker and strumella canker. Hispidus canker is caused by the fungus *Polyporus hispidus* (Bull.) Fr. *P. hispidus* infections occur through wounds resulting from fire, frost cracks, or mechanical injuries such as logging damage. Frequently, the fungus gains access to the heartwood through dead branch stubs. The cambium is killed and the resulting canker becomes progressively larger. Unlike the common heart rot fungi that are restricted to heartwood, *P. hispidus* forms external cankers (Fig. 1). This is a primary characteristic that distinguishes the stem canker diseases from the multitude of heart and butt rot fungi. *P. hispidus* fruiting bodies have a dark brown velvety upper surface and a golden brown under surface (Overholts, 1953). The conks are relatively large (up to ten inches wide), spongy when fresh and are attached directly to the trunk (Fig. 2). The sporophores may occur on cankers anywhere along the tree trunk from DBH to as high as 20 - 30 feet. Sporophore production occurs in the Fall. By early winter the conks begin to dry out and usually fall off the tree. The black shriveled masses (old conks) can frequently be found at the base of cankered trees throughout the winter. Therefore, *P. hispidus* sporophore production is annual with new fruiting bodies being produced each year.

The decay associated with hispidus cankers is a soft, spongy white rot (Roth, 1959). Decayed wood is straw colored to brown with the textural characteristic of sawdust and is often marked with a dark zone between decayed and unaffected wood (Fig. 3). Loss due to decay associated with hispidus cankers was found to be 33% of the board-foot volume on one sample plot in Connecticut (Sleeth and Bidwell, 1937).

Another important hardwood stem canker disease is caused by the fungus *Strumella coryneoidea* Sacc. and Wint. Infection by this fungus also occurs primarily through branch stubs. Trees of the red oak group are preferred host species. Cankers with ridges of callus growth frequently accompanied by a branch stub in their center typify infected trees (Fig. 4). During the winter, *S. coryneoidea* reinfects callus tissue grown the

Fig. 1 Hispidus stem canker on chestnut oak.

Fig. 2 *Polyporus hispidus* fruiting bodies on stem of chestnut oak.

Fig. 3 Type of stem rot associated with *P. hispidus* infection in a 40-year-old chestnut oak. Note the dark stained zone between rotted and unaffected wood and the relationship of the canker with the rot.

Fig. 4. Strumella canker on scarlet oak. Note the dead branch stub in center of canker signifying the probable entry point for the fungus.

previous summer. Therefore, canker enlargement occurs during the host's dormant season. The ridges formed around the canker periphery is a result of this alternation between formation of callus tissue and fungal reinfection.

S. coryneoidea fruiting bodies are never found in association with stem cankers on living trees. The small grayish-brown fruiting structures are formed only on dead trees in the vicinity of the canker (Fig. 5).

Trees with strumella cankers rarely heal and wind breakage at the canker is common. The disease rarely affects more than three percent of the trees in a stand. Economically speaking, however, damage may be significant as infection usually occurs in the lower stem affecting the valuable butt log. Also, cankered trees left in the woods occupy growing space and take up nutrients that could be utilized by more valuable trees (Houston, 1966).

During a previous white pine blister rust evaluation on the Jefferson National Forest and adjacent areas in southwestern Virginia, numerous chestnut and scarlet oaks on control grid R-142 were observed with *P. hispidus* sporophores and stem cankers. Therefore, a hardwood stem canker disease survey was conducted in the affected area in November, 1968. The primary objectives of this survey were to determine the incidence of stem canker diseases along with the extent of decay and cull associated with the cankers.

Participants on the field survey, in addition to the authors, included R.F. Bassett, Division of Forest Pest Control, Asheville, John Severt and Bill Trivett, Virginia Division of Forestry and Wade Rogers, Holston Ranger District, Jefferson National Forest. Assistance provided by these men was most helpful in collecting the field data.

METHODS

The area surveyed is located on Iron Mountain in Grayson County, Virginia and is a part of the Mt. Rogers National Recreation Area on the Holston Ranger District, Jefferson National Forest (Fig. 6).

Fig. 5 *Strumella coryneoidea* fruiting bodies (small inconspicuous brown structures) on stem of dead oak.

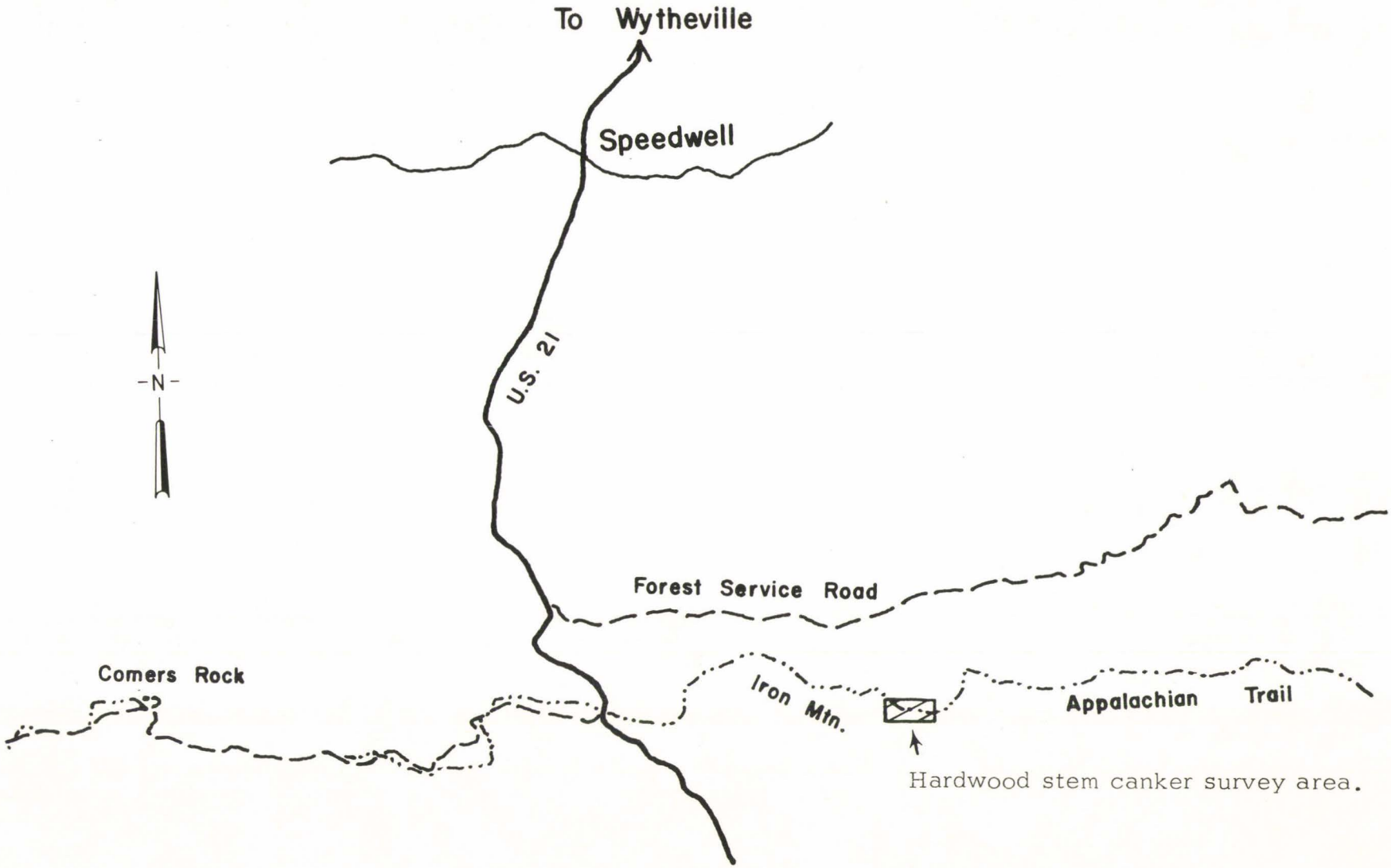

Fig. 6 Area surveyed for hardwood stem canker diseases in southwestern Virginia.

Two parallel survey lines were run in an east-west direction along each side of the prevailing ridge top. The approximate elevation of the survey area is 3,500 feet. Twelve one-tenth acre temporary circular plots were established at five-chain intervals along the two lines. The following information was recorded on each plot:

1. Number of living oaks (four inches or larger DBH).

2. Number of cankered oaks (hispidus or strumella).

3. Number of oaks with *P. hispidus* fruiting bodies.

4. Number of oaks with obvious defects other than cankers.

5. Number of dead oaks.

6. Canker length and extent of decay (in terms of length and percent of stem cross-section decayed) on one cankered oak per plot.

One cankered oak per plot was felled, dissected and examined for extent of decay behind the canker. The canker and decay column length were recorded as well as the percent of decay in the stem cross-section at canker center. Samples were collected from the dissected trees for laboratory diagnosis.

RESULTS

The survey results are summarized in Table 1. Eleven percent of the scarlet and chestnut oaks examined had hispidus or strumella cankers. The majority of these cankers displayed *P. hispidus* fruiting bodies and/or typical hispidus decay behind the canker faces (Fig. 3). Several cankered trees also had decay patterns characterized by *Stereum gausapatum* infection. The cultures revealed several other organisms such as *Armillaria mellea* and *Irpex mollis*.

The average decay column length (7.9 ft.) was nearly four times the average canker length (2.0 ft.). The average amount of cross-sectional area decay at the canker center was 22%.

Table 1 - Incidence of Hardwood Stem Cankers and Extent of Associated Stem Decay on Scarlet and Chestnut Oaks on a Selected area in southwestern Virginia.

Plot No.	Oaks Examined Number [1]	Cankered oaks [2]		Defective oaks		Dead oaks		Canker [3]	Decay [3]	
		Number	Percent	Number	Percent	Number	Percent	length(in.)	length(in.)	Percent [4]
1	24	1	4.2	5	20.8	4	16.7	20	20	33
2	14	1	7.1	4	28.4	1	7.1	36	36	25
3	15	2	13.3	1	6.7	0	0	16	10	25
4	7	2	28.6	3	42.9	0	0	24	58	10
5	39	1	2.6	2	5.2	1	2.6	6	36	10
6	23	2	8.7	1	4.3	2	8.7	24	144	10
7	17	5	29.4	3	17.7	1	5.9	30	396	10
8	28	5	17.9	4	14.3	9	32.1	26	96	50
9	9	4	44.4	0	0	0	0	60	120	10
10	32	1	3.1	1	3.1	1	3.1	6	18	10
11	11	1	9.1	5	45.5	2	18.2	42	204	75
12	6	0	0	2	33.3	0	0	0	0	0
Total	225	25	11.1	31	13.8	21	9.3	24.2	94.8	22

1/ Scarlet and chestnut oaks to a minimum four inches DBH; 2/ Hispidus (Polyporus hispidus) or strumella (Strumella coryneoidea) cankers; 3/ Measured on one cankered oak per plot; 4/ Percent of stem cross section decayed at canker center.

An additional 14% of the oaks examined displayed stem defects indicating possible interior decay. Therefore, one-fourth of the 225 oaks examined either had stem cankers or some other visible defects such as open frost cracks, swollen stems or basal wounds from past fire damage. The majority of the cankered and/or otherwise defective trees would be classed as unmerchantable by present sawlog grading standards.

Mortality from all causes was nine percent. It was not possible to ascribe any portion of this mortality to a particular cause.

DISCUSSION

This limited evaluation of hardwood stem canker diseases revealed several interesting observations. Probably most significant was the extent of decay behind the cankers. The survey results showed that decay columns averaged four times the length of stem cankers on scarlet and chestnut oaks in this particular area. There was a wide variation in both canker and decay length. Canker length ranged from six inches to 60 inches while decay length ranged from ten inches to 396 inches. The decay pattern in one scarlet oak extended throughout the entire tree length (33 feet), while the canker length was only 30 inches.

The above observations indicate that the old "rule of thumb" of one foot above and one foot below visible cankers for estimating cull allowance may be invalid in certain areas. It is obvious from this survey that one-foot-cull allowance would not be sufficient for cankered scarlet and chestnut oaks in this particular area.

Basal wounds were observed throughout the survey area. While there are no past records of fire occurrence, there is a good probability of the wounds having been initiated by fire. A small fire (two to three acres) occurred in the southwest corner of the survey area in November, 1967. The majority of the trees had basal fire scorches and dead inner bark as evidenced by bark cracking. This would be an interesting area to examine in the future to observe the relationship between hardwood stem disease development and past fire occurrence.

This survey, although limited, also gave the participants a unique chance to take a critical look at some of the poorer southern Appalachian hardwood sites from a disease standpoint. It is evident that relatively little emphasis

has been placed on hardwood disease problems in the past. The authors hope that this study will stimulate more interest and will be but the first in a series of cooperative projects on hardwood diseases between the Division of Forest Pest Control and the Virginia Division of Forestry.

RECOMMENDATIONS

1. Control methods for canker-rot diseases in forest stands involve the manipulation of silvicultural practices. When practical this approach should be taken to prevent the incidence of stem canker diseases.

2. On timber sales where timber values warrant a more accurate stumpage appraisal than usual, a relatively small amount of selective tree dissection may be desirable in estimating cull factors associated with stem cankers, conks and other external indicators.

3. Timber marking and T.S.I. crews should be trained in recognition of external indicators of decay such as cankers, conks, swellings, broken branches, butt bulges and fire scars. Incipient decay is frequently overlooked in T.S.I. and timber marking work.

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More detailed information can be obtained by writing to the Forest Pest Control Division Field Offices listed below or to the Atlanta Office.

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